

PATENT SPECIFICATION

(11) 1312083

1312083

NO DRAWINGS

(21) Application No. 30457/70 (22) Filed 23 June 1970
 (31) Convention Application No. 56851 (32) Filed 23 June 1969 in
 (33) Australia (AU)
 (44) Complete Specification published 4 April 1973
 (51) International Classification C08F 29/46-45/02//C09D 3/28
 (52) Index at acceptance



C3P 4C13B 4C14A 4C18 4C20B 4C8B 4C9 4D3B1 8C13C
 8C14A 8C14B 8C15 8C18 8C20B 8C20C 8C20D1
 8C20D3 8CS 8C6B 8C8B 8C8C 8C9 8D2B2 8D5
 8F1 8K8

C4A 4P

(54) COATING COMPOSITIONS

(71) We, BALM PAINTS LIMITED, of 1, Nicholson Street, Melbourne, Australia, a Company organised and existing under the laws of the State of Victoria, Commonwealth of Australia, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to novel non-glossy coating compositions and in particular to such compositions comprising spheroidal pigmented polymer granules.

Coating compositions which form films exhibiting a bright, mirror-like surface, on a substrate, that is surfaces with a high specular reflection, are commonly known in the art as glossy or high-gloss coatings. When this specular reflection is reduced by scattering or diffusion of incident light at the surface, the compositions are described by such terms as satin, eggshell, low-lustre, flat, matte, or broadly as non-glossy coatings. Although the above terms are derived from the appearance of the coating films, they are commonly applied in the art to both the films and the compositions from which the films are formed. For example an enamel which provides a matte coating on a substrate is itself referred to as a matte enamel.

It has been proposed hitherto to produce non-glossy coatings by incorporating pigment particles in a film-forming composition at a sufficient volume concentration to disrupt the surface of a film formed therefrom, inducing surface diffusion and deliberately lowering the degree of specular reflection. In a typical non-glossy coating a portion of the pigment used is a low refractive index 'extender' pigment, for example clay, talc, or whiting, the proportion of prime pigment (e.g. titanium dioxide) which can be used being limited by economic or other factors. However, it is known that

the introduction of extender pigment into a film can adversely affect certain of its properties. For example, when the extender is relatively coarse, e.g. 10—60 micron, the opacity of the film at the volume concentration of extender required to achieve the target gloss level may be unacceptably low. On the other hand, when very fine extenders, e.g. below one micron particle diameter, are used these may have a less pronounced adverse effect on the opacity of the film, but other problems can arise. For example, at the required gloss level the film may have poor abrasion resistance. It may, in fact, be found that as the extender concentration is increased, the compositions produce brittle, unacceptable films; before a point is reached at which the gloss is reduced sufficiently. Hence, it is not uncommon for a formulator to be faced with the necessity to strike a balance between gloss level and other film properties, especially opacity and mechanical strength, which falls short of the overall balance of properties which he is attempting to achieve.

We have now found that a range of non-glossy coating compositions in which the inherent limitations on the achievable variations in properties are surprisingly broad can be prepared by using certain rigid spheroidal pigmented polymer granules as hereinunder defined, optionally in combination with a proportion of extender pigment, as gloss-reducing components of the compositions.

According to the present invention we provide a non-glossy coating composition consisting essentially of:

- (a) at least 5% but less than 45% by volume of the total solids of the composition of rigid spheroidal pigmented polymer granules having a particle diameter of 1—100 micron and comprising 1—80% by volume of pigment,
- (b) a film-forming medium which will provide 10—70% by volume of the total

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solids of the composition of a polymeric binder, and
 5 (c) pigment, other than that in component (a), comprising 0-80% by volume of extender pigment at a concentration such that the volume fraction of pigment in the combination of pigment and polymeric binder is 10-80%, provided also that the weight fraction of said pigment in the said combination must be at least 42%.

It is to be understood that in addition to the above-defined essential elements the composition may comprise other auxiliary materials which, although not mandatory to the performance of the invention, may be present in the composition for certain well-known practical reasons. For example, the composition may be a dry, non-glossy film on a substrate, in which case the composition may contain only pigmented polymer granules, polymeric binder and pigment. More commonly, however, it will also contain a minor proportion, typically less than 2% by weight based on the weight of composition, of other auxiliary materials such as, for example, dispersing agents, viscosity modifiers and catalyst residues, which are related to the conditions under which coating films are applied to a substrate but are only incidental to the present invention. Alternatively, the composition may be a liquid coating composition adapted to form a non-glossy coating on a substrate. When this is so, the composition may comprise volatile liquids in which the film-forming medium is dissolved or dispersed to assist in applying it to the substrate. Such liquids play no significant part in determining the composition of the coating itself and relative to the invention we consider them as non-essential auxiliary materials.

The spheroidal pigmented polymer granules function as gloss-reducing components of the compositions. To do this, they must retain their discrete identity in the coating composition and hence they must be inert toward and insoluble in the film-forming medium and should not flow or decompose at the temperature at which the coating film is to be formed. When the coating composition comprises organic liquids, for example as a solvent for the film-forming medium, the granules must be similarly inert toward that liquid. The liquid may cause some temporary softening of the granules but this is not objectionable provided they return to substantially their original dimensions and rigidity on removal of the liquid. In order to provide hard, durable films we require that the granules be rigid, relatively inflexible, as distinct from pliable, rubbery bodies. These conditions are met when, for example, they exhibit an elongation at break of 40% maximum when tested by the American Society for Testing and Materials Method D-412-61T. Because of the

physical impossibility of performing the elongation test on an individual granule, we carry it out on a rod or film having the composition of the pigmented polymer granules.

The coating compositions toward which this invention is directed provide films of relatively uniform visual appearance. To achieve this we require that the polymer granules should have a diameter of 1-100 micron. It is not practical nor is it necessary to fractionate the granules to the exclusion of all particles lying outside of these dimensions. For many applications, the presence of a minor proportion of over-sized granules in the film (e.g. less than 10% by weight) is not objectionable, but when films of the composition exhibit an unacceptable seedy appearance due to the incidental presence of over-sized granules, the remedy is simply to eliminate these granules, for example by a fractionation process, before preparing the compositions. Furthermore, we have found that granules of less than one micron diameter have relatively little effect as gloss-reducing components and in calculating the composition of the coatings as hereinabove defined we treat any polymeric granules which have a diameter of less than one micron as extender pigment. For the best results the granules should have a weight average mean diameter of at least 3 micron.

The diameter of the granules is conveniently measured as a Stokes diameter by a liquid sedimentation method, e.g. using an Andreason pipette. A suitable method is described in British Standard 3406: Part 2. A Stokes diameter/weight fraction curve for the granules is plotted from these measurements and the weight average mean Stokes diameter derived arithmetically therefrom.

The polymeric composition of the granules is not critical provided the above requirements of inertness and rigidity are met. For example the granules may comprise condensation polymers, e.g. polyester, maleic adducts, phenol-formaldehyde, urea-formaldehyde and epoxy resins.

Especially suitable polymers for the spheroidal granules are addition polymers and in particular addition polymers of α, β -ethylenically unsaturated monomers. For example, the granules may comprise polymers of at least one of the following monomers:

aromatic substituted ethylene, e.g. styrene, α -methyl styrene and the mixed isomers known as vinyl toluene; vinyl acetate and vinyl chloride; lower saturated alcohol esters of acrylic and methacrylic acid, e.g. their methyl, ethyl and n -butyl esters; acrylonitrile and methacrylonitrile.

A convenient way of increasing the toughness and hardness of the polymer is to introduce therein a controlled degree of cross-linking. For example a cross-linked copolymer may be formed by the addition copolymerisa-

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tion of methyl methacrylate monomer containing a minor proportion, e.g. 1—5% by weight of divinyl benzene.

5 Alternatively, the resinous particles may comprise essentially linear copolymers of ethylene, propylene, isoprene, chloroprene and butadiene.

10 The granules may, but need not, comprise polymer of the same chemical type as that of the polymeric binder. The pigment to be used in the granules may be, for example:

15 a prime white pigment, that is an opaque pigment with a refractive index of greater than 1.9 e.g. titanium dioxide, zinc oxide and antimony oxide; a coloured inorganic pigment, e.g. oxides and hydroxides oxides of iron, prussian blue and lead chromes; an organic pigment, e.g. C.I. Pigment Red 3, 4, 6 and 48, C.I. Pigment Yellow 1 and 3, C.I. Pigment Violet 19, C.I. Vat Yellow 1 and carbon black.

20 The C.I. pigment numbers refer to the classified groups of pigments as set out in the "Society of Dyers and Colourists, Colour Index", Second Edition and Supplement, 1963.

25 The pigment may also comprise a low refractive index extender pigment, for example calcium carbonate, silica, barium sulphate, alumina and naturally occurring aluminium silicates, e.g. kaolinite, dickite and montmorillonite.

30 A single pigment or a mixture of two or more such pigments may be present in the granules.

35 Although the granules may comprise from 1—80% by volume of pigment particles it is known in the art that the volume of pigment which can be incorporated into a given polymer depends on factors such as the specific surface area of that pigment. For example while 80% of γ -titania can be satisfactorily incorporated into a granule of e.g. poly(styrene) the corresponding practical limita-

40 tion for carbon black may well be of the order of 40—60%. That is at extreme concentrations of carbon black, a coherent mass of pigmented polymer will not form, while at somewhat lower concentrations the pigmented granules are so friable that they disintegrate during incorporation into the aqueous latex; the pigment particles are then commonly referred to as being under-bound.

45 It is to be understood that the known criteria by which under-bound pigmented polymer mixtures are recognised and overcome by reducing the proportion of pigment in the mixture are to be applied in preparing pigmented polymer granules which have sufficient mechanical strength to remain intact when incorporated into the coating composition.

50 The presence of pigment in the granule can contribute to the colour and/or opacity of the coating. Alternatively, when the pigment is a low refractive index 'extender' pigment it

55 may primarily be responsible for increasing the hardness of the polymeric granule, although somewhat surprisingly we have found that granules so-pigmented can contribute some opacity to the coating film in which they are embedded.

60 In a preferred embodiment of our invention the compositions provide high-opacity coatings on a substrate and in this embodiment in particular we prefer that the polymer granules comprise 10—40% by volume of prime white pigment, the preferred prime pigment being titanium dioxide.

65 The pigment must be insoluble in the polymer of the granule and when it is to be present during the reaction by which the polymer is formed, it must be inert with respect to the reaction and insoluble in the reactants.

70 The particle-size of the pigment must obviously be less than that of the granules. For example if the granules comprise some particles with a diameter approaching 1 micron it is clearly not possible to prepare these from pigment particles with a diameter of say 5 micron or greater.

75 The granules may be prepared by milling preformed bulk pigmented polymer to the required particle-size distribution. While this method of manufacture can yield satisfactory granules, it tends to produce a preponderance of very fine and/or non-spheroidal granules which require further after-treatment to give an acceptable product.

80 An alternative preferred method is to disperse the pigment in a suitable polymerisable monomer which is then emulsified in water and polymerised to form insoluble granules of the required composition. By the careful control of reaction conditions granules of the required particle-size distribution can be made directly and are then either separated mechanically from the water or when the coating composition comprises an aqueous liquid, incorporated directly into the composition as a slurry.

85 For example titanium dioxide dispersed in methyl methacrylate monomer can be emulsified in water in the presence of an emulsion stabiliser, the monomer then being polymerised by heat and the addition of a free radical initiator to produce water-insoluble spheroidal granules of poly(methyl methacrylate) pigmented with titanium dioxide.

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techniques by which pigment may be evenly dispersed throughout a bulk polymer or a polymerisable monomer are well-known and involve an initial wetting of the particles, 5 optionally aided by the addition of suitable wetting agents, followed by stabilisation of the dispersion so-formed.

The film-forming medium in the sense in which it is used in this invention, consists of a component or components which, in a dried film of the composition, provide a polymeric binder in which the remaining solid constituents of the composition are embedded. It is not necessary that in a liquid composition 10 the film-forming medium should be entirely polymeric, but if it is not so, it must form a polymeric binder during the film-forming process. The medium may itself be polymeric, in which case it will usually be present in a 15 liquid composition as a dispersion or solution in suitable mobile and volatile liquids. Alternatively it may comprise precursor elements, optionally dissolved in suitable solvents, which react to produce the polymeric binder. However, it is only those materials 20 which persist in a dried film of the composition as polymeric binder which we refer to as the film-forming medium. When it is an integral and essential part of the polymeric 25 binder, a non-volatile plasticiser, for example 2-ethyl hexyl phthalate, is considered to be part of the film-forming medium although in itself it is not polymeric.

Those skilled in the art will recognise that 30 there are many materials available which meet our requirements for a suitable film-forming medium. The following are some typical non-restricting examples:

The film-forming medium may be simply 35 an autoxidizable oil, for example linseed, tung, safflower, soya or dehydrated castor oil, either alone or in combination. It may also be an oleoresinous varnish comprising one or more of the above oils in combination with e.g. a 40 phenol-formaldehyde resin, maleic resin or an ester gum.

The film-forming medium may also be chosen from at least one of the synthetic resins 45 commonly used as binding media in coating compositions. For example it may be selected from oil modified alkyd resins, phenol-formaldehyde, melamine formaldehyde or epoxy resins.

A particularly useful group of resins are 50 the addition polymers and copolymers of α,β -ethylenically unsaturated monomers, which permit of considerable scope in formulation because of the ease with which many of them can be incorporated into liquid coating compositions as solutions, aqueous latices or non-aqueous dispersions. For example the film-forming medium may be a homopolymer or 55 copolymer of the following classes of monomers:

60 vinyl esters and ethers, alkyl acrylates and

methacrylates, alkyl fumarates and maleates, halogenated vinyls, aryl vinyls and olefins.

For example suitable monomers are vinyl acetate, vinyl propionate, vinyl caproate, vinyl stearate, vinyl esters of saturated tertiary 70 monocarboxylic acids, vinyl siloxanes and the saturated mono-hydric alcohol esters of unsaturated acids, e.g. acrylic acid, methacrylic acid, maleic acid and fumaric acid, including those esters derived from methanol, ethanol, *n*-propanol, *iso*-propanol, *n*-butanol, *iso*-butanol, cyclohexanol, 2-ethyl hexanol, dodecanol, hexadecanol and octanol. Other suitable monomers include vinyl chloride, vinylidene chloride, vinylidene fluoride, styrene, α -methyl styrene, the commercial 75 mixed isomers known as vinyl toluene, and acrylonitrile. The copolymers may contain a proportion, usually a minor proportion, e.g. 1-5% by weight, of the above unsaturated acids themselves.

Examples of film-forming media which are not initially completely polymeric are a mixture of a material, usually a polymeric material, containing two or more epoxide groups with an epoxy-reactive polyamide, or a polymeric precursor comprising a plurality of hydroxyl groups in combination with a di-isocyanate. In each of these mixtures the components 80 combine during the film-forming process to form a polymeric binder.

We place no restrictions on the choice of pigment, which may be selected from those materials commonly used in surface-coatings compositions. The purpose of the pigment is primarily to impart opacity and/or colour to the coating and suitable types of pigment are described above with reference to the polymer granules. In general, these pigments have 85 a particle size of 2 micron or less, although certain pigments, for example oxides of iron, are typically somewhat larger, e.g. 15-20 micron. The particle size of the pigment selected is, apart from the fact that it must obviously be less than that of the granules, no more critical for the performance of the present invention than for the preparation of other coating compositions.

The extender pigments may, in general, be 90 similarly chosen from those particulate solids of relatively low refractive index conventionally used in coating composition to, for example, modify the mechanical properties 95 of coating films. However, we have found that the size and shape of the extender can influence certain properties of our compositions, for example the opacity and mechanical integrity of the films. For the best results we prefer the extender to have a particle-size of 100 from 1-50 micron, more preferably from 105 5-30 micron weight average mean diameter and that it shall be acicular or plate-like 110 rather than chunky or globular. We have found, for example, that the use of coarser 115 extenders can mar the surface uniformity of 120 125 130

coating films while sub-sized extenders may reduce their mechanical strength. The incorporation of extender pigment into coating films comprising pigment and spheroidal pigmented polymer granules may lower their opacity, but we have found that this effect is minimised if the extender particles have an acicular or plate-like structure.

It has been proposed to utilise certain insoluble particulate solids which do not strictly conform to the commonly understood meaning of either pigment or extender, as functional components of coating compositions. For example, certain inorganic salts, e.g. barium metaborate have been proposed as additions to coating compositions at a volume concentration (on coating solids) of the order of 10%, as fungicides. Unless these materials are clearly sufficiently highly coloured or opaque to be considered as pigment, we treat them for the purpose of this invention as extenders.

When the coating compositions comprise both pigment and extender, we have found that the usefulness of coating films formed therefrom is reduced substantially if the relative proportion of extender is too high. Accordingly, as mentioned above, we limit the proportion of extender to a maximum of 80% by volume of the total volume of pigment and extender. Furthermore, in order to provide suitably hard and durable films, we require that the total weight and volume of pigment in the compositions be maintained within the above-mentioned limits.

Non-glossy coating films are formed when coating compositions consisting essentially of the components in combination as hereinabove defined are applied to a substrate and allowed to solidify. The coatings are applied in liquid form by conventional means, for example brushing, spraying or dipping and formation of the dried film may be accelerated by heating and/or addition of a catalyst to the composition. The formation of a dry film may involve no more than the removal of volatile liquids in which the film-forming medium has been dissolved or dispersed, optionally accompanied by some chemical curing of the medium itself. On the other hand, the medium itself may, when compounded with the other composition components, yield a sufficiently fluid liquid which subsequently cures by chemical reaction to a coherent, solidified coating.

Liquid compositions are prepared by dispersing pigment and, when present, extender into at least part of the film-forming medium by known means and then stirring the pigmented polymer granules into this mixture. If it is not inherently sufficiently fluid, the film-forming medium may be dispersed or dissolved in suitable liquid before it is pigmented. When the film-forming medium consists of at least two components which co-react

to provide film-forming polymer it is usual to add pigment and polymer granules to only one component of the medium, the balance of the medium being added to this first mixture prior to use.

The invention is illustrated by Examples 1-3 and 7 in which all proportions are expressed by weight:

Example 1

Preparation of a satin pigmented coating composition in which the total solids consist essentially of spheroidal pigmented polymer granules, poly(methyl methacrylate) binder and titanium dioxide in the proportions by volume of 31/57/12.

A lacquer base was prepared by normal paint-making dispersion techniques from the following materials.

	Parts
poly(methyl methacrylate) solution, 40% solids	85
titanium dioxide	40.6
ethylene glycol monoethyl ether	16.1
acetate	8.3
toluene	5.7
<i>n</i> -butyl benzyl phthalate	90
acetone	6.2
silicone flow additive	3.4
	0.1

To the dispersion was added with stirring 13.0 parts of spheroidal pigmented polymer granules consisting of 1.5% by volume of titanium dioxide dispersed in poly(methyl methacrylate/ethylene glycol dimethacrylate) of 93/7 monomer ratio by weight. The granules were of from 1-80 micron diameter with a weight average mean diameter of 30 micron.

The volume fraction of pigment in the combination of pigment and polymeric binder was 17.4% and the weight fraction 43%.

When applied by spray onto steel panels the composition dried in air to a hard coating of low lustre and uniform, smooth appearance. The lacquer base without granules, when sprayed under the same conditions, produced smooth, glossy films on the panels.

Example 2

Preparation of a flat pigmented coating composition in which the total solids consist essentially of spheroidal pigmented polymer granules, poly(vinyl acetate) binder and pigment in the proportions by volume of 38.5/21.5/40. The pigment consists of titanium dioxide and extender pigment in which the proportion of extender is 56.5% by volume.

A paint base was prepared by normal latex paint manufacturing techniques from the following materials:

		Parts	2, thus demonstrating the advantage of using a plate-like extender of the talc type over the nodular barytes.	65
	talc. (200 mesh)	11.00		
	titanium dioxide	11.85		
	sodium hexametaphosphate	0.10		
5	proprietary defoamer	0.04		
	hydroxyethyl cellulose (2.5% by weight aqueous solution)	28.80		
	water	15.73		
10	poly(vinyl acetate) aqueous latex, 55% solids by weight	7.93		70
	propylene glycol	1.14		
	tri-n-butyl phosphate	0.17		

To the dispersion was added with stirring 23.3 parts of a 48% solids by weight aqueous slurry of spheroidal pigmented polymer granules consisting of 16.0% by volume of titanium dioxide dispersed in poly(methyl methacrylate/ethylene glycol dimethacrylate) of 98/2 monomer ratio by weight. The granules were of from 1-40 micron diameter with a weight average mean particle diameter of 13 micron.

The volume fraction of pigment in the combination of pigment and polymeric binder was 65% and the weight fraction 82%.

When applied by brush to plaster board panels and allowed to dry in air the composition formed uniform, matte coating films of excellent opacity. The dry films showed good resistance to rubbing with a wet cloth.

Example 3

A similar coating composition to that of example 2 is prepared at the same ratios by volume of polymeric granules, binder and pigment but replacing the talc of that example by an equal volume of barytes.

By the general method of example 2 a paint of the following composition was prepared:

		Parts		
40	barytes (200 mesh)	16.40		
	titanium dioxide	11.10		
	sodium hexametaphosphate	0.10		
	proprietary defoamer	0.04		
	hydroxyethyl cellulose (2.5% by weight aqueous solution)	27.10		
	water	14.70		
45	poly(vinyl acetate) aqueous latex, 55% solids by weight	7.40		
	propylene glycol	1.06		
50	tri-n-butyl phosphate	0.10		
	aqueous slurry of polymer granules (as in example 2)	22.0		

The weight fraction of pigment in the combination of pigment and polymeric binder was 85.0%.

When applied by brush to plaster board panels and allowed to dry in air the composition formed uniform, matte coating films of good opacity. However, the opacity of the films was approximately 50% lower than those formed from the composition of example

Example 4

Preparation of flat pigmented coating composition in which the total solids consist essentially of spheroidal pigmented polymer granules, poly(vinyl acetate) binder and pigment in the proportions by volume of 45.5/7.1/47.4. The pigment consists of titanium dioxide and extender pigment in which the proportion of extender is 56% by volume. The volume concentration of binder is lower than the minimum amount required for the performance of the invention.

By the general method of example 2 a paint of the following composition was prepared:

		Parts		
	talc (200 mesh)	11.70	80	
	titanium dioxide	12.50		
	sodium hexametaphosphate	0.10		
	proprietary defoamer	0.04		
	hydroxyethyl cellulose (2.5% by weight aqueous solution)	30.50	85	
	water	16.80		
25	poly(vinyl acetate) aqueous latex, 55% solids by weight	2.46		
	propylene glycol	1.20		
	tri-n-butyl phosphate	0.20	90	
	aqueous slurry of polymer granules (as in example 2)	24.50		

The volume fraction of pigment in the combination of pigment and polymeric binder was 88.6% and the weight fraction 91.0%.

When applied by brush to plaster board panels and allowed to dry in air the composition formed uniform, matte coating films of excellent opacity but in contrast to composition of the invention the films were readily wiped from the substrate on scrubbing with a wet cloth.

Example 5

Preparation of a flat, pigmented coating composition in which the total solids consist essentially of spheroidal pigmented polymer granules, acrylic copolymer binder and pigment in the proportions by volume of 20/40/40. The pigment consists of titanium dioxide and extender pigment in which the proportion of extender is 95% and thus lies outside of the limits of the invention.

By the general method of example 2 a paint of the following composition was prepared:

		Parts		
	talc (200 mesh)	22.00	115	
	titanium dioxide	1.85		
	sodium hexametaphosphate	0.10		
	hydroxyethyl cellulose (2.5% by weight aqueous solution)	18.60	120	

	water	Parts		Parts
	proprietary acrylic copolymer aqueous latex, 46.5% solids by weight	18.65	talc (200 B.S. mesh)	7.12
5	aqueous slurry of polymer granules (as in example 2)	23.40	silica (240 B.S. mesh)	5.10
		15.40	titanium dioxide	19.30
10	The volume fraction of pigment in the combination of pigment and polymeric binder was 50.0% and the weight fraction 68.0%.		sodium hexametaphosphate	0.16
15	When applied by brush to plaster board panels and allowed to dry in air the composition formed uniform, matte coating films of good integrity on washing but the opacity was very low when compared with compositions according to the invention.		soya lecithin	0.19
20	Preparation of a satin, pigmented coating composition in which the total solids consist essentially of spheroidal pigmented polymer granules, acrylic copolymer binder and titanium dioxide in the proportions by volume of 30/67/3. The pigment content is below the lower weight and volume concentration according to the invention.		proprietary defoamer	0.16
25	By the general method of example 2 a paint of the following composition was prepared:		mercurial fungicide	0.04
30	titanium dioxide	Parts	hydroxyethyl cellulose	0.39
	sodium hexametaphosphate	4.6	proprietary acrylic copolymer	
	proprietary acrylic copolymer aqueous latex, 46.5% solids by weight	0.2	aqueous latex, 46.5% solids by weight	29.60
35	aqueous slurry of polymer granules (as in example 2)	56.6	water	28.85
		38.6	tri-n-butyl phosphate	0.32
40	The volume fraction of pigment in the combination of pigment and polymeric binder was 4.4% and the weight fraction 15.0%.		ammonia (0.880 grade)	0.05
	When applied by brush to plaster board sheets and allowed to dry in air composition formed satin coating films of good integrity on scrubbing with a wet cloth but the opacity was poor when compared with compositions according to the invention.		propylene glycol	1.25
45	Preparation of a semi-matte pigmented coating composition in which the total solids consist essentially of spheroidal pigmented polymer granules, acrylic copolymer binder and pigment in the proportions by volume of 10.2/49.2/40.6. The pigment consists of titanium dioxide and extender pigment in which the proportion of extender is 46.5% by volume.		aqueous slurry of polymer granules (as example 2)	7.90
50	By the general method of example 2 a paint was prepared from the following materials:	75		

Example 6

Preparation of a satin, pigmented coating composition in which the total solids consist essentially of spheroidal pigmented polymer granules, acrylic copolymer binder and titanium dioxide in the proportions by volume of 30/67/3. The pigment content is below the lower weight and volume concentration according to the invention.

By the general method of example 2 a paint of the following composition was prepared:

	titanium dioxide	Parts
30	sodium hexametaphosphate	4.6
	proprietary acrylic copolymer aqueous latex, 46.5% solids by weight	0.2
35	aqueous slurry of polymer granules (as in example 2)	56.6
		38.6

The volume fraction of pigment in the combination of pigment and polymeric binder was 4.4% and the weight fraction 15.0%.

When applied by brush to plaster board sheets and allowed to dry in air composition formed satin coating films of good integrity on scrubbing with a wet cloth but the opacity was poor when compared with compositions according to the invention.

Example 7

Preparation of a semi-matte pigmented coating composition in which the total solids consist essentially of spheroidal pigmented polymer granules, acrylic copolymer binder and pigment in the proportions by volume of 10.2/49.2/40.6. The pigment consists of titanium dioxide and extender pigment in which the proportion of extender is 46.5% by volume.

By the general method of example 2 a paint was prepared from the following materials:

The volume fraction of pigment in the combination of pigment and polymeric binder was 45.1% and the weight fraction 69.0%.

When applied by brush to plaster board panels and allowed to dry in air the compositions formed semi-matte films of good opacity and resistance to rubbing with a wet cloth. When compared with coating films formed from a composition in which the granules were replaced by an equal volume of pigment (in the above proportions) but identical in all other respects, the compositions of the invention exhibited a more uniform appearance and superior resistance to marring when scrubbed with a wet cloth.

WHAT WE CLAIM IS:—

1. A non-glossy coating composition consisting essentially of:
 - (a) at least 5% but less than 45% by volume of the total solids of the composition of rigid spheroidal pigmented polymer granules having a particle diameter of 1—100 micron and comprising 1—80% by volume of pigment, a film-forming medium as hereinabove defined which will provide 10—70% by volume of the total solids of the composition, of a polymeric binder, and
 - (b) pigment other than that in component (a), comprising 0—80% by volume of extender pigment, at a concentration such that the volume fraction of pigment in the combination of pigment and polymeric binder is 10—80%, provided also that the weight fraction of said pigment in the said combination must be at least 42%.
 - (c) a non-glossy coating composition according to Claim 1 in which the polymer granules have an elongation at break of 40% maximum as measured by the method hereinbefore defined.
 2. A non-glossy coating composition according to Claim 1 in which the polymer granules have an elongation at break of 40% maximum as measured by the method hereinbefore defined.
 3. A non-glossy coating composition according to Claim 1 or Claim 2 wherein

the pigmented polymer granules have a weight average mean diameter of at least 3 micron.

4. A non-glossy coating composition according to any one of Claims 1-3 wherein the pigmented polymer granules comprise 10-40% by volume of prime white pigment.

5. A non-glossy coating composition according to any one of Claims 1-4 wherein the extender pigment is acicular or plate-like and 10 has a particle size of from 1-50 micron weight average mean diameter.

6. A non-glossy coating composition according to Claim 5 wherein the extender has

a particle-size of from 5-30 micron weight average mean diameter.

7. A non-glossy coating composition substantially as herein described and with reference to any one of Examples 1-3 and 7.

8. A non-glossy coating film on a substrate formed by applying a coating composition according to any one of Claims 1-7 to the substrate and allowing the coating to solidify.

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Printed for Her Majesty's Stationery Office, by the Courier Press, Leamington Spa, 1973.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from
which copies may be obtained.